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The ants of a vine thicket near Broome: a comparison with the northwest Kimberley

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Abstract

A vine thicket located 3 km NW of Broome is the most southerly 'rainforest' habitat in Western Australia, and is therefore of considerable biogeographic interest. Its ant fauna was sampled with pitfall traps following the procedure used by Andersen and Majer (in press) at 8 vine thickets in the northwest Kimberley region. A total of 23 species were recorded, with the tropical tramp species *Paratrechina longicornis* comprising 55% of total captures. As was the case in the northwest Kimberley, arid-adapted taxa of the surrounding savanna (*eg* species of *Iridomyrmex, Melophorus, Meranoplus*) were poorly represented, and two unspecialized functional groups ('opportunists' and 'generalized myrmicines') predominated. Compared with the ants of related habitats in the northwest Kimberley, those of the Broome vine thicket appear to have little biogeographic significance, and the predominance of *P. longicornis* is indicative of a high degree of habitat disturbance. These features reflect both the extreme southerly location of the thicket and its close proximity to human settlement, and serve as a basis for predicting the kinds of changes likely to occur following disturbance in other vine thickets of the Kimberley region.

Introduction

In Western Australia, tropical rainforest vegetation is represented by small vine thickets scattered throughout that part of the seasonally arid Kimberley region where mean annual rainfall exceeds 500 mm. They are primarily on sites holding permanent water, or on sheltered rocky slopes, particularly at the bases of cliffs and plateaus (Stoneman *et al.* in press). The thickets are dominated by broad-leaved tree and vine species occurring in the humid rainforests of northeast Queensland. These rainforest islands occur in a vast sea of savanna and sclerophyll woodland, and this, combined with their huge distance from 'mainland' formations on the eastern coast, makes them of considerable biogeographic interest.

Few vertebrate species appear to be locally restricted to vine thickets (Friend *et al.* in press, Johnstone & Burbidge in press, Kendrick & Rolfe in press), but the invertebrate fauna of these habitats is of special significance. For example, of the 119 land snail species recorded from Kimberley vine thickets, 51 are known only from these habitats, and many appear to have extremely restricted distributions (Solem in press). All 26 species of pseudoscorpions collected during a recent survey of Kimberley vine thickets were undescribed (Harvey in press), and included a family (Feaellidae) previously recorded only from rainforests of Africa and India (Harvey 1989). In an intensive study of the ant faunas of eight vine thickets in the northwest Kimberley region, Andersen & Majer (in press) recorded many taxa characteristic of tropical rainforests, including certain species of *Cerapachys, Leptogenys, Cardiocondyla* and *Polyrhachis*, which were absent from surrounding habitats.

Here we describe the ant fauna of a vine thicket on the outskirts of Broome, and compare it with those recorded by Andersen & Majer in the northwest Kimberley. The Broome vine thicket has two special features. First, it is the most southerly of all known such habitats, located about 20 km from the nearest thicket, and about 300 km from where such thickets are common. Second, it suffers from obvious signs of disturbance, including cattle grazing, burning, and rubbish dumping, associated with its close proximity to human settlement.

Methods

The vine thicket is located 3 km NW of Broome, and occupies a total area of about 10 ha. It is long and thin in shape, lying just behind and parallel with the dunes

fringing Gantheaume Bay. All but about 2 ha is very open and patchy, with canopy cover being extremely variable and having many gaps. About 30 perennial plant species are known from the thicket, with the common ones including *Lysiphyllum cunninghamii* (Caesalpiniaceae), *Terminalia ferdinandiana* (Combretaceae) and *Pouteria sericea* (Sapotaceae). *Passiflora foetida* (Passifloraceae), a weedy species characteristic of disturbed sites in tropical Australia, is present. Litter depth varies up to 2 cm, with many bare patches. At the time of sampling, both litter and soil were dry, at least to a depth of 20 cm. The thicket occurs on both pale grey coastal calcareous dune sand, and on the red aeolian sand immediately inland. The study area was located on the latter soil type, near its boundary with dune sand.

Ants were sampled with pitfall traps, following the trapping procedure used by Andersen & Majer. Traps (4.2 cm diameter, partly filled with ethanol as a preservative) were spaced 5 m apart and arranged along two perpendicular 50 m transects. They were operated for a 48 hr period during late June 1988 (compared with 72 hr periods during early to mid-June 1988 for the northwest Kimberley study). One trap was unable to be found, so that data are available for 19 rather than 20 traps.

Ants were sorted to species level but, as is the case throughout northern Australia, most could not be identified with certainty. Unidentified species were therefore allocated code numbers, which follow and extend those used by Andersen & Majer. A full collection of voucher specimens is held by the senior author, and an incomplete collection is lodged in the Western Australian Museum.

The biogeographical affinity of each species was determined according to whether the distributions of related taxa are centred in tropical (Torresian distribution), arid (Eyrean) or cool-temperate (Bassian) regions, or are widespread. These determinations were based on the senior author's understanding of the Australian ant fauna, as no comprehensive biogeographic treatment of the fauna has been published. Ant community organization was investigated by assigning species to functional groups based on their habitat requirements and their competitive interactions, as outlined by Andersen & Majer.

Results and Discussion

Species Composition

A total of 23 ant species were recorded in traps (Table 1), with the richest genera being *Monomorium* (6 species), *Paratrechina* (3), *Iridomyrmex* (3) and *Rhytidoponera* (3). The tramp species *Paratrechina longicornis* was by far the most abundant ant (recorded in all but one trap, representing 55% total ants), with *Monomorium* spp., *Solenopsis* sp., *Rhytidoponera* sp. *aurata* gp and another species of *Paratrechina* also commonly recorded (Table 1).

Although the Broome thicket is relatively rich in species, only five are among those (n=102) recorded by Andersen & Majer (in press) in vine thickets of the northwest Kimberley. Moreover, the biogeographical profile of the Broome vine thicket fauna differs markedly from that recorded by Andersen & Majer (Table 2). In the northwest Kimberley, 54% of vine thicket species have Torresian affinities, compared with only 22% in Broome. Conversely, 26% of Broome species belong to Eyrean taxa, compared with only 7% in the northwest Kimberley.

Table 1

Ant species recorded in pitfall traps in the Broome vine thicket. The biogeographical affinity (T = Torresian, E = Eyrean, B = Bassian, W = Widespread) of each species is given. Numbers are total ants in traps, with frequency of occurrence (n = 19) in brackets.

Taxon	Biogeography	Records
Subfamily Ponerinae		
* *Odontomachus ruficeps*	T	1 (1)
Rhytidoponera sp. nr. *reticulata*	E	3 (2)
Rhytidoponera sp. *convexa* gp	E	5 (4)
Rhytidoponera sp. nr. *aurata*	E	18 (6)
Subfamily Myrmicinae		
* *Monomorium* sp. A1	W	41 (7)
Monomorium sp. A4	W	1 (1)
Monomorium sp. A5	W	5 (3)
* *Monomorium* sp. B3	W	9 (4)
Monomorium sp. B5	W	46 (5)
Monomorium sp. C	W	11 (2)
* *Solenopsis* sp. A	W	25 (6)
Solenopsis sp. C	W	2 (1)
Tetramorium sp. *spininode* gp.	E	1 (1)
Subfamily Dolichoderinae		
Iridomyrmex sp. *nitidus* gp.	W	2 (2)
Iridomyrmex sp. A2	T	7 (3)
Iridomyrmex sp. B2	W	2 (2)
Subfamily Formicinae		
Camponotus sp. A4	T	10 (6)
Camponotus sp. *discors* gp.	W	1 (1)
Melophorus sp. A	E	1 (1)
Paratrechina sp. *minutula* gp. C	E	1 (1)
Paratrechina sp. A3	T	24 (5)
* *P. longicornis*	T	260 (18)
Polyrhachis sp. *inconspicua* gp.	B	1 (1)
	Total	477 (83)

* Species recorded by Andersen & Majer (in press) in vine thickets of the northwest Kimberley region.

Indeed, the biogeographical profile of the Broome vine thicket fauna is remarkably similar to that of savanna habitats of the Kakadu region of the Northern Territory (Table 2).

Of the five Torresian species recorded in the present study, *P.longicornis* occurs throughout the tropics where it is characteristic of anthropogenic habitats (Wilson & Taylor 1967), and the others are widely distributed in savanna and woodland habitats of northwestern Australia (A N Andersen, unpubl). None of the species can therefore be considered characteristic of tropical rainforests, unlike the situation in the northwest Kimberley (Andersen & Majer in press). It is noteworthy that the southern limit of distribution on the west coast of the green tree ant, *Oecophylla smaragdina*, is at Broome (Lok-

kers 1986). This species is a dominant ant in vine thickets of the northwest Kimberley, but was not recorded in the present study, nor has it been observed by B Wells or P Foulkes (pers comm) who have considerable familiarity with the thicket.

Table 2

Biogeographical affinities of species recorded in the Broome vine thicket, compared with those of vine thickets in the northwest Kimberley (Andersen & Majer in press) and those of mostly savanna habitats in Kakadu National Park (Greenslade 1985). Numbers represent percentage total species (n = 23, 102 and 104 respectively).

	Broome	Northwest Kimberley	Kakadu
Torresian	22	55	20
Eyrean	26	2	22
Bassian	4	5	5
Widespread	48	38	53

Community Organization

While the species composition differs, the broad pattern of ant community organization (Table 3) in the Broome vine thicket is similar to that recorded in the northwest Kimberley study. Dominant *Iridomyrmex*, ground-foraging subordinate species, and hot-climate specialists were all poorly represented. These are all arid-adapted taxa that are patchily distributed within vine thickets of the Kimberley region, and often are only locally common within canopy gaps. Opportunists and generalized myrmicines comprised the large majority (90% in Broome, average of 77% in the northwest Kimberley) of total ants. The predominance of these unspecialized species presumably reflects the lack of competition from arid-adapted taxa, especially species of *Iridomyrmex* (Andersen & Majer in press).

The most striking feature of the Broome ant community is the predominance of *P. longicornis*, which represented 55% of total ants recorded in traps. The species is locally abundant in anthropogenic and other disturbed habitats throughout sub-coastal northern Australia (eg Andersen 1990), but has never been observed to be abundant in other habitats (A N Andersen unpub obs). In the northwest Kimberley study, it was only recorded in a single trap at a single site. Its extreme abundance at the Broome site is therefore a clear reflection of habitat disturbance.

Conclusion

More intensive sampling, particularly within litter and on vegetation, might reveal that some ant species characteristic of tropical rainforests do occur in the Broome vine thicket. However their absence from pitfall traps, combined with the general biogeographical profile of the species recorded, suggest that the ant fauna of the thicket has little biogeographic significance when compared with related habitats in the northwest Kimberley. Moreover,

Table 3

Ant community organization in the Broome vine thicket compared with vine thickets of the northwest Kimberley (Andersen & Majer in press). Ant species are classified into functional groups (see text), and data are percentage abundance in pitfall traps (+ present, but < 1%).

Functional group/taxon	Broome	Northwest Kimberley mean (range)
Dominant species		
Iridomyrmex	2	1 (0 - 7)
Oecophylla	0	4 (1 -16)
sub-total	2	5 (1 -16)
Associated subordinate species		
Camponotus	2	1 (0 - 4)
Polyrhachis	+	1 (0 - 4)
other	0	+ (0 - 1)
sub-total	2	2 (0 - 4)
Hot climate specialists		
Melophorus	+	0
other	0	7 (1 -17)
sub-total	+	7 (1 -17)
Cryptic species		
Paratrechina sp. *minutula* gp	+	4 (1 -17)
Solenopsis	5	3 (0 -15)
other	0	2 (0 - 4)
sub-total	5	9 (1 -36)
Opportunists		
Odontomachus	+	5 (1 -14)
Paratrechina	60	4 (0 -14)
Rhytidoponera	6	2 (1 - 8)
Tetramorium	+	14 (1 -51)
other	0	2 (0 - 9)
sub-total	66	27 (5 -81)
Generalized myrmicines		
Monomorium	24	17 (0 -35)
other	0	33 (0 -78)
sub-total	24	50 (9 -78)
Total no. species in traps	23	16 (11-24)
Total no. ants in traps	477	225(69-336)

the predominance of *P. longicornis* indicates that the ant fauna has been seriously disturbed. These features reflect both the extreme southerly location of the thicket, and the high level of disturbance due to its close proximity to human settlement.

Although this study is based on only one site, the results are of value in predicting the kinds of changes likely to occur in ant communities following disturbance in other vine thickets of the Kimberley region - namely incursions of arid-adapted species from the surrounding savannas, and of tropical tramp species. Together with the results of Andersen & Majer (in press), they provide a framework within which to assess the results of any future

monitoring of ant communities in these special habitats. Moreover, because ants integrate a particularly broad range of environmental variables (Andersen 1990), they are likely to provide a useful general indication of the status of the habitat in which they live. We predict that the biogeographic profile and level of disturbance shown by the ant fauna is matched by other faunal groups. To date, detailed data are available only for birds (Johnstone & Burbidge in press, B Wells & G Hooper pers comm), and these are consistent with our prediction. Unlike the situation in the northwest Kimberley, the avifauna contains no rainforest specialists such as the Scrubfowl (*Megapodius reinwardt*), Rainbow Pitta (*Pitta iris*), Emerald Dove (*Chalcophaps indica*), Rose-crowned Fruit-Dove (*Ptilinopus regina*) or Little Shrike-thrush (*Colluricincla megarhyncha*).

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